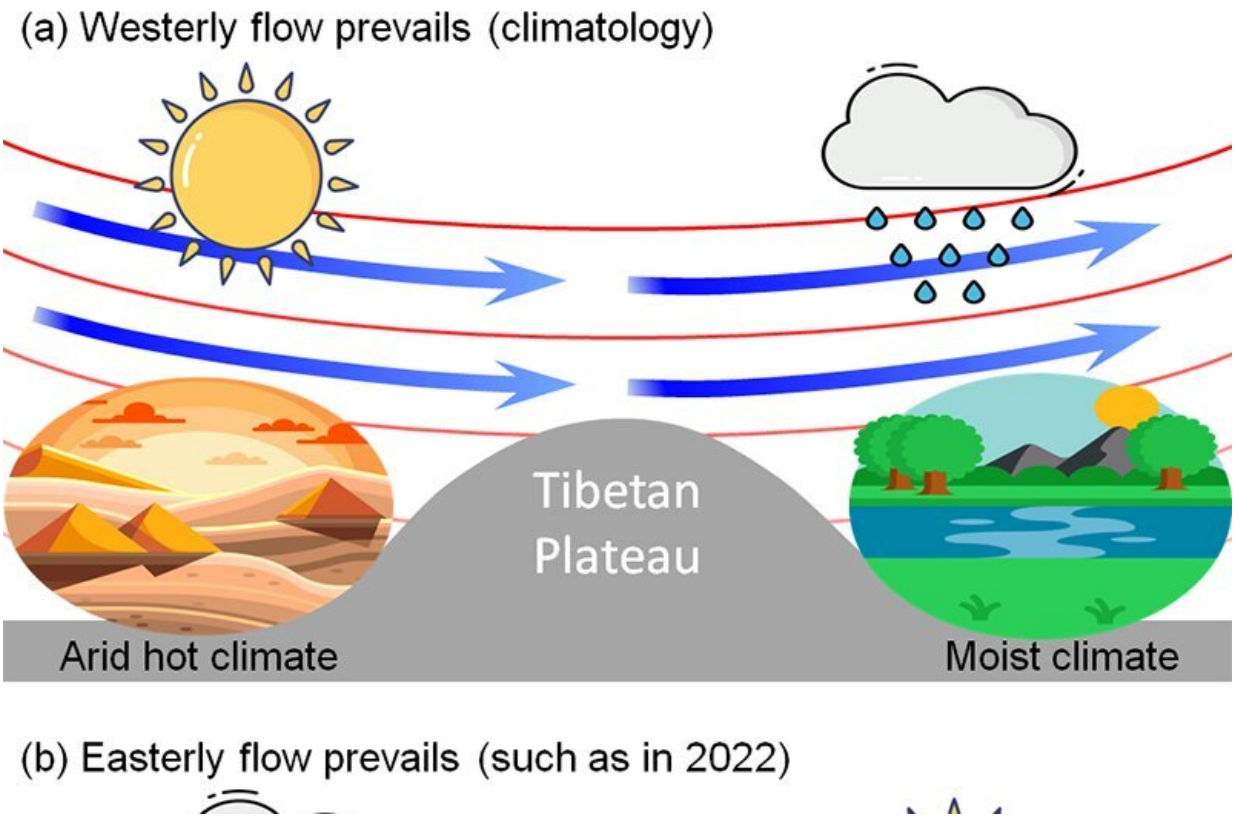
Reversal of Tibetan Plateau flow blamed for 2022 heat wave

January 17 2023, by Li Yuan



Schematic diagram illustrating the mechanism how Asian summer climate is connected to the zonal flow over the Tibetan Plateau. (a) Climatological westerly flow prevails. (b) Easterly flow prevails such as in 2022. Credit: He Chao

In the mid-summer (July–August) of 2022, extreme climate events occurred over subtropical Asia. Persistent heat waves hit the Yangtze

River valley in East Asia, bringing secondary disasters such as drought, wildfires and power shortage. At the same time, frequent rainstorms and floods swept the desert areas from Western South Asia to West Asia.

The above two extreme climate events occurred simultaneously in subtropical Asia around 30°N, on the eastern and western side of the Tibetan Plateau (TP), respectively. The possible linkage between them and their possible causes remain unclear.

A recent study, published in *Climate Dynamics* on Jan. 12, has highlighted the reversal of zonal flow over the Tibetan Plateau.

Heat waves in summer result directly from strong descending motion of the atmosphere, while rainstorms and floods are driven by strong ascent. "It is essential to understand why strong descent appeared on the eastern side while strong ascent appeared on the western side of the Tibetan Plateau in 2022," said Dr. He Chao, a research fellow from Jinan University, and the first author of the study.

Atmospheric flow is constrained by physical laws, and an important rule is that adiabatic air parcels must move along isentropic surfaces. Isentropic surfaces do not exactly follow a horizontal distribution, and they tilt slightly according to the thermal structure of the atmosphere. Therefore, adiabatic flow may move upward/downward along the sloping isentropic surface and generate vertical motion.

Following the atmospheric thermal structure over the Tibetan Plateau, the prevailing westerly flow near 30°N induces descent on the western side and ascent on the eastern side, accounting for the formation of the desert climate on the western side and the humid climate on the eastern side of the Tibetan Plateau in summer.

However, the westerly flow over the Tibetan Plateau reversed into

easterly flow in the summer of 2022, and it induced persistent descent and heat waves on the eastern side, and ascent and excessive rainfall on the western side of the Tibetan Plateau.

"The mechanism can be simply understood as a 'swap' of the climate states between the eastern and western sides, due to the reversed flow over the Tibetan Plateau in the summer of 2022," said Dr. He Chao.

The reversed flow is suggested to be caused by the synergistic effects of atmospheric internal variability and oceanic forcing. An atmospheric wave train in the mid latitudes brought a clockwise rotational flow on the northern flank of the Tibetan Plateau, and it weakened the westerly flow. This part of atmospheric circulation change is due to internal variability and thus highly unpredictable. Associated with a La Nina event, the tropical Indian Ocean was cooler than normal in the summer of 2022, and it further reduced the westerly flow over subtropical Tibetan Plateau and increased the possibility of a reversed flow.

"Understanding the dynamics of extreme climate is a pre-requisite for predicting extreme climate," said Dr. Zhang Lixia from the Institute of Atmospheric Physics, Chinese Academy of Sciences, a coauthor of the study. "This study explains the concurrent occurrence of extreme climates across East Asia and Western South Asia in the summer of 2022. The results have implications for both climate attributions and climate projections."

More information: Chao He et al, Extremely hot East Asia and flooding western South Asia in the summer of 2022 tied to reversed flow over Tibetan Plateau, *Climate Dynamics* (2023). DOI: 10.1007/s00382-023-06669-y

Provided by Chinese Academy of Sciences

Citation: Reversal of Tibetan Plateau flow blamed for 2022 heat wave (2023, January 17) retrieved 26 June 2024 from https://phys.org/news/2023-01-reversal-tibetan-plateau-blamed.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.